

Section 4.3

Equipping Your Function Toolkit

Curriculum Outcomes	Related Activities	Page in Text
<ul style="list-style-type: none"> model real-world phenomena with linear, quadratic, exponential and power equations, and linear inequalities 	<ul style="list-style-type: none"> four connected investigations that will explore parameter changes in the graphs of functions 	174, 176, 178, 180
<ul style="list-style-type: none"> analyze and describe transformations of quadratic functions and apply them to absolute value functions express transformations algebraically and with mapping rules graph equations and inequalities and analyze graphs both with and without graphing technology apply transformations when solving problems use transformations to draw graphs 	<ul style="list-style-type: none"> an introduction to the absolute value function is given for those students not familiar with the absolute value function 	183

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Transformations

Transformations are a form of math where we are comparing two different graphs to see how they have moved. There are 4 different types of transformations that we will be talking about in this unit.

In order to compare graphs, we must first graph our equations.

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Create a table of values (using the same values as seen below) and graph each of the following.

1. $y = x^2$

2. $y = -x^2 \rightarrow -(-3)^2 = -9$

3. $y = x^2 + 3$

4. $y = x^2 - 6$

5. $y = 2x^2$

$y = x^2$

x	y
-3	9
-2	4
-1	
0	
1	
2	
3	

$(-3, 9)$
 $(-2, 4)$

How to find the "y" in the table of values:

Example:

$y = x^2$
 $y = (-3)^2$
 $y = 9$

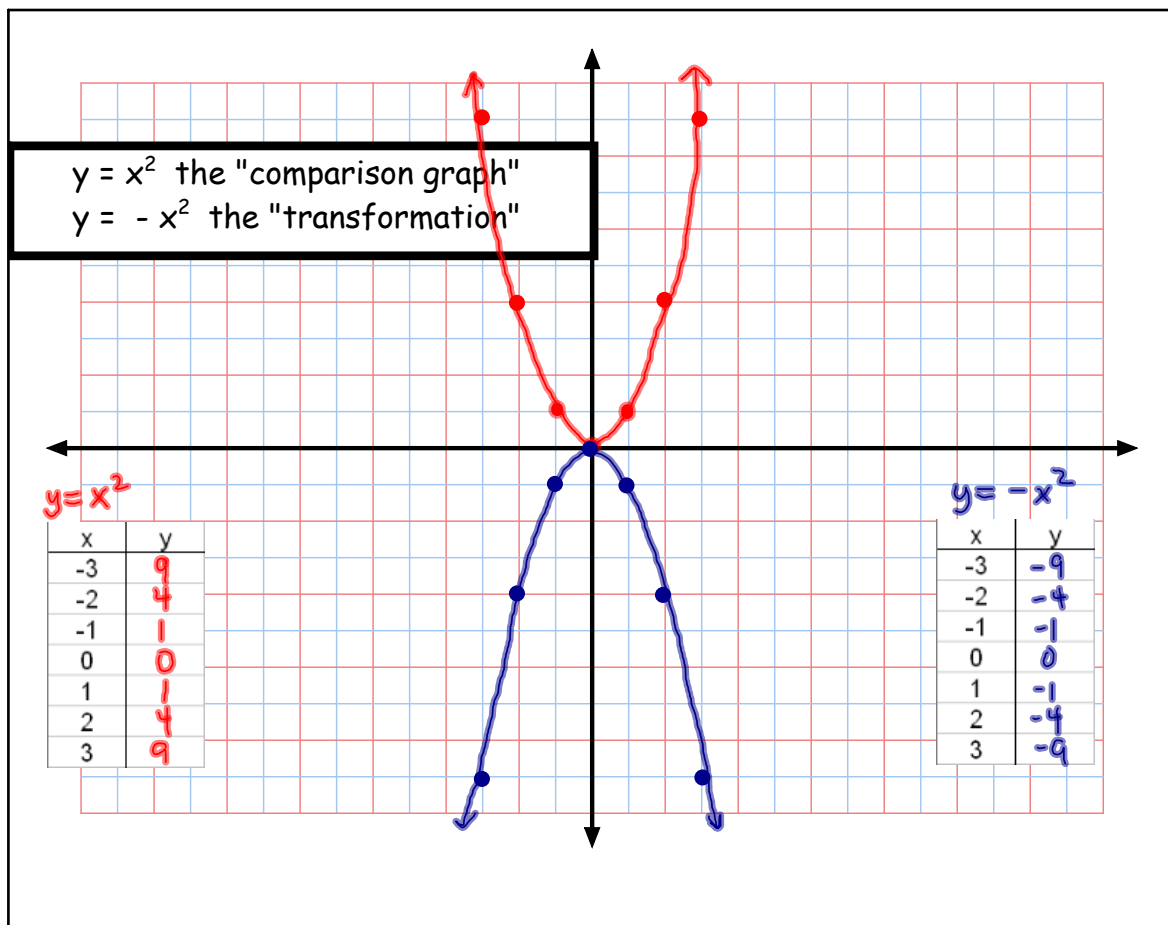
Using $y = x^2$

your first point to plot will be $(-3, 9)$

Compare each graph to the $y = x^2$ graph

- $y = -x^2$ ----> what changed?
- $y = x^2 + 3$ ----> what changed?
- $y = x^2 - 6$ ----> what changed?

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$$y = -x^2$$

How do the 2 graphs compare?

We can describe how the 2 graphs compare verbally....

"Reflected" or "Flipped" over the x-axis.

And we can describe how the 2 graphs compare mathematically, using what we call "mapping notation"

$$y = x^2$$

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

$$y = -x^2$$

x	y
-3	-9
-2	-4
-1	-1
0	0
1	-1
2	-4
3	-9

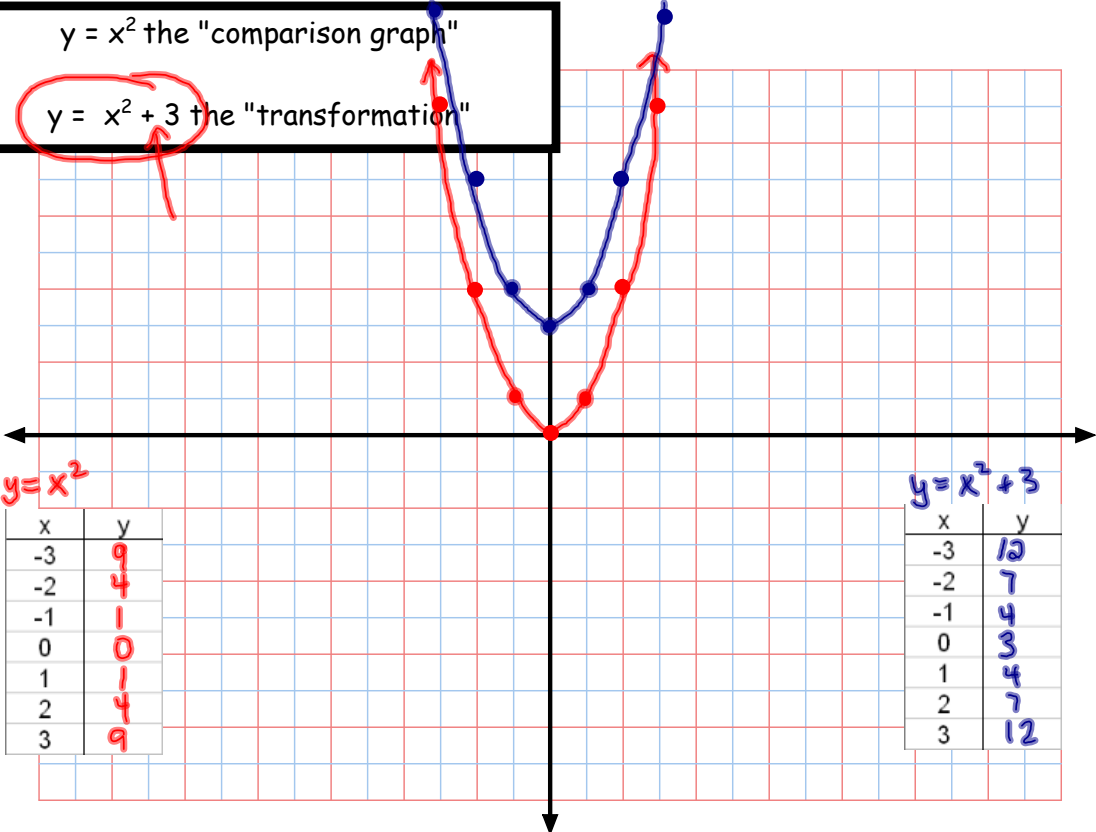
$$(x, y) \longrightarrow (x, -y)$$

Notice:
Each y-value was multiplied by a negative.

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$y = x^2$ the "comparison graph"

$y = x^2 + 3$ the "transformation"



$$y = x^2$$

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

$$y = x^2 + 3$$

x	y
-3	12
-2	7
-1	4
0	3
1	4
2	7
3	12

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$$y = x^2 + 3$$

How do the 2 graphs compare?

We can describe how the 2 graphs compare verbally....

→ "Translation" or "slide" up 3 units

And we can describe how the 2 graphs compare mathematically, using what we call "mapping notation"

$$y = x^2$$

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

$$y = x^2 + 3$$

x	y
-3	12
-2	7
-1	4
0	3
1	4
2	7
3	12

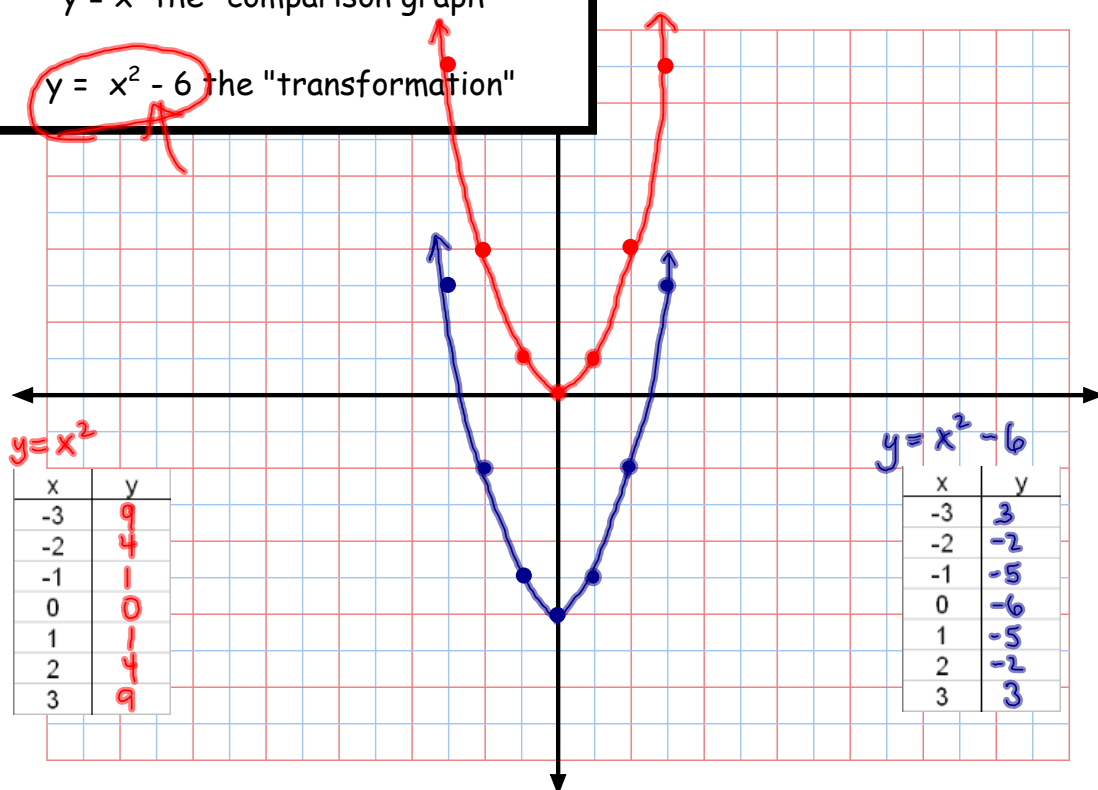
Notice:
Each y-value
had 3 added
to it.

$$(x, y) \longrightarrow (x, y + 3)$$

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$y = x^2$ the "comparison graph"

$y = x^2 - 6$ the "transformation"



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$$y = x^2 - 6$$

How do the 2 graphs compare?

We can describe how the 2 graphs compare verbally....

→ "Translation" or "slide" down 6 units

And we can describe how the 2 graphs compare mathematically, using what we call "mapping notation"

$$y = x^2$$

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

$$y = x^2 - 6$$

x	y
-3	3
-2	-2
-1	-5
0	-6
1	-5
2	-2
3	3

Notice:

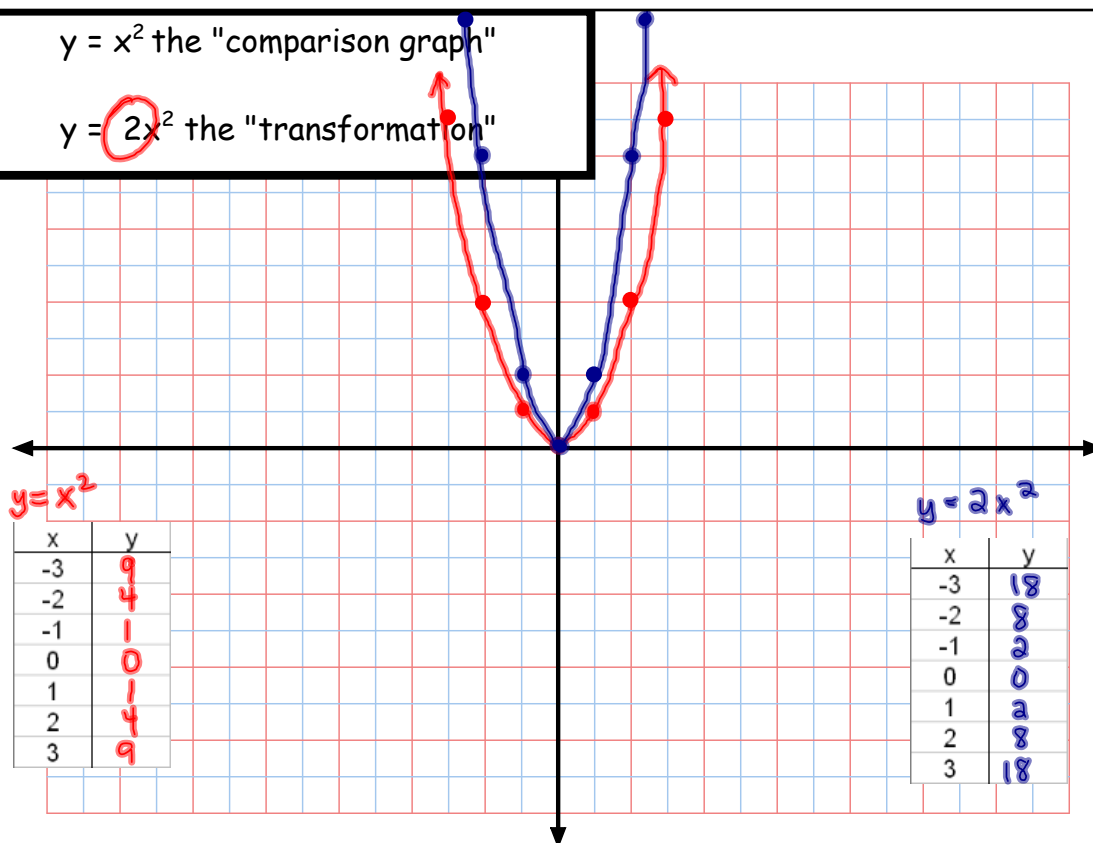
Each y-value had 6 subtracted from it.

$$(x, y) \longrightarrow (x, y-6)$$

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$y = x^2$ the "comparison graph"

$y = 2x^2$ the "transformation"



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$$y = 2x^2$$

How do the 2 graphs compare?

We can describe how the 2 graphs compare verbally....

Vertical stretch of 2.
(2 times narrower)

And we can describe how the 2 graphs compare mathematically, using what we call "mapping notation"

$$y = x^2$$

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

$$y = 2x^2$$

x	y
-3	18
-2	8
-1	2
0	0
1	2
2	8
3	18

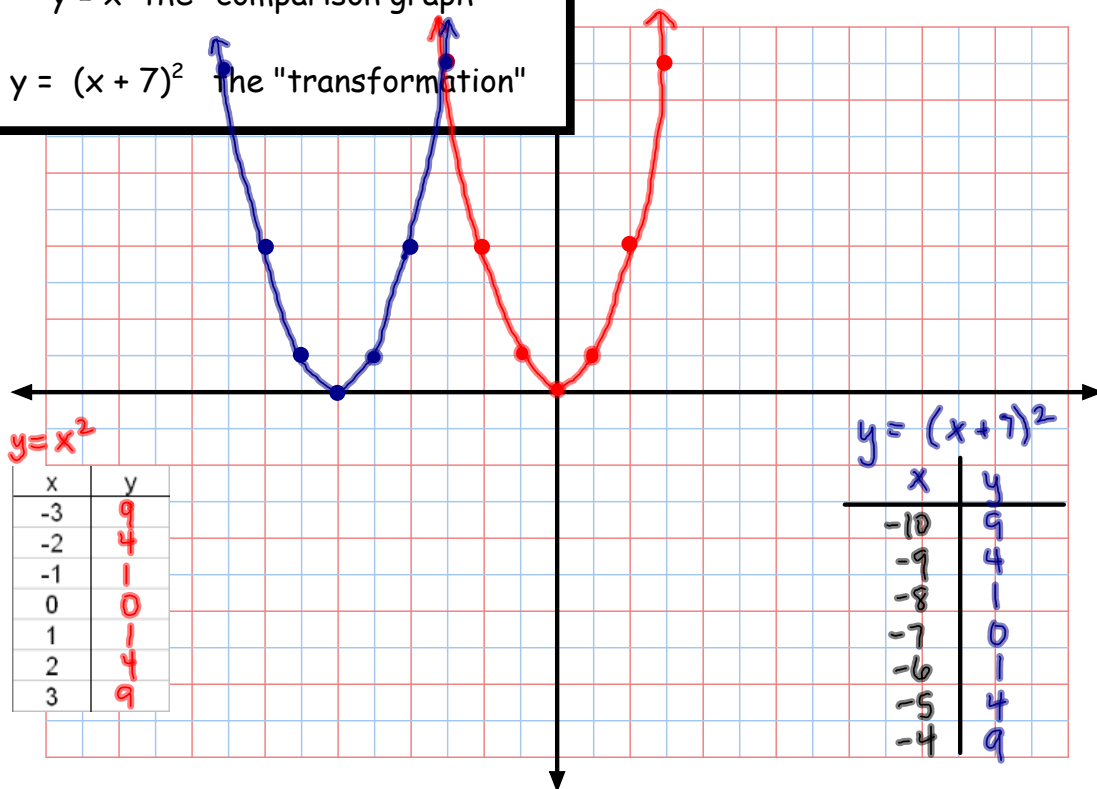
Notice:
Each y-value doubled.

$$(x, y) \longrightarrow (x, 2y)$$

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$y = x^2$ the "comparison graph"

$y = (x + 7)^2$ the "transformation"



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$$y = (x + 7)^2$$

How do the 2 graphs compare?

We can describe how the 2 graphs compare verbally....

"Translation" or "slide" to the left 7 units

And we can describe how the 2 graphs compare mathematically, using what we call "mapping notation"

$$y = x^2$$

x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9

$$y = (x + 7)^2$$

x	y
-10	9
-9	4
-8	1
-7	0
-6	1
-5	4
-4	9

$$(x, y) \longrightarrow (x - 7, y)$$

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Standard Form Vs. Transformational Form

The standard form of an equation is the form you are used to using

- it has y by itself

$$y = -x^2$$

$$y = -x^2 - 1$$

$$y = x^2 + 8$$

The transformational form of an equation is a form that has the x^2 by itself

$$y = -x^2$$

$$y = -x^2 - 1$$

$$y = x^2 + 8$$

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If you are given an equation that is not in standard form, you will need to rearrange it so that it is.

This is necessary to create a table of values!

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Copy & Complete the following table:

SF - Standard form Ref - Reflection VT - Vertical Translation
TF - Transformational form VS - Vertical Stretch HT - Horizontal Translation.

SF $y =$	TF $= x^2$	Ref (yes/no)	VS y/n	VT up/down	HT left/right	Mapping Notation $(x,y) \rightarrow (,)$
$y = x^2 + 1$						
$y = x^2 + 4$						
$y = x^2 - 2$						
$y = -x^2 + 1$						
$y = -x^2 + 7$						
$y = x^2 - 6$						

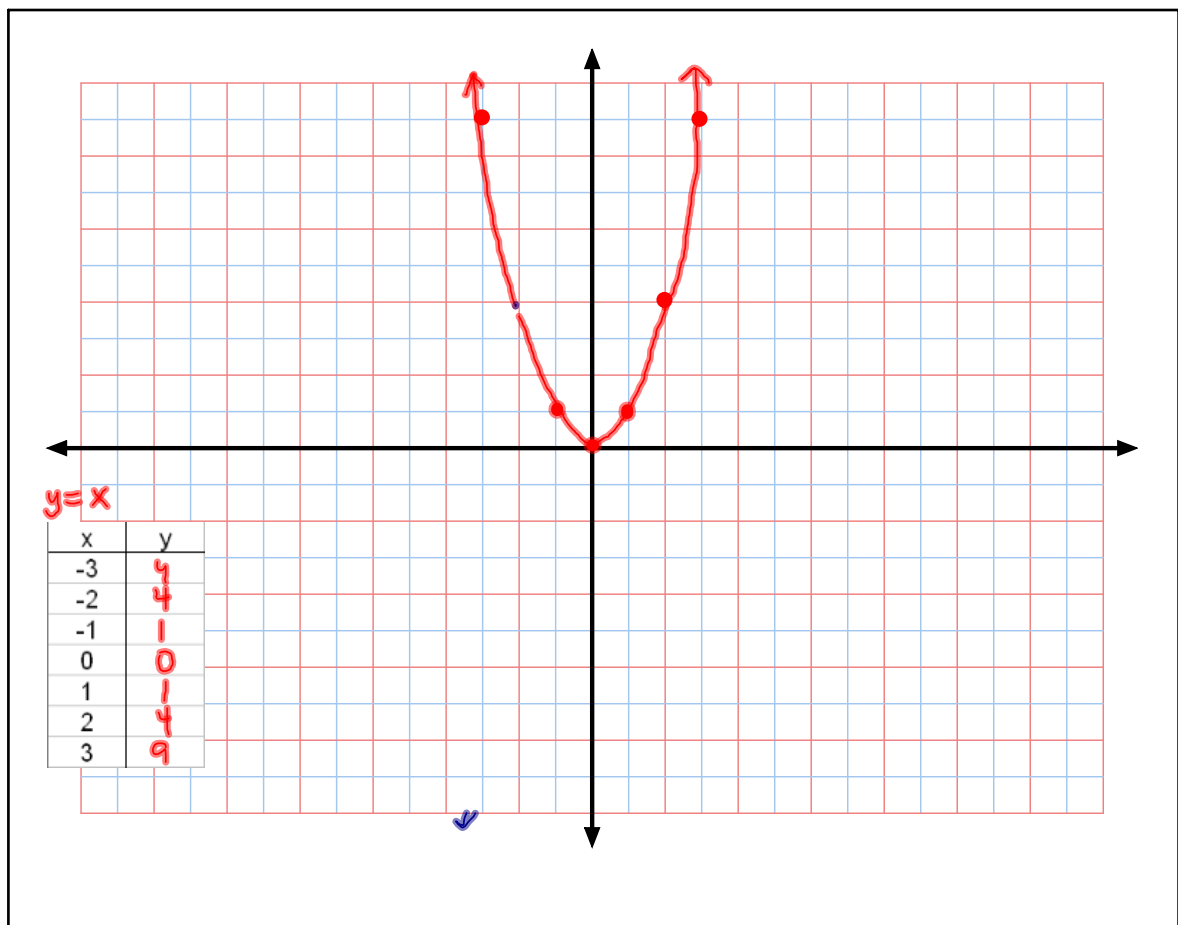
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Copy & Complete the following table:

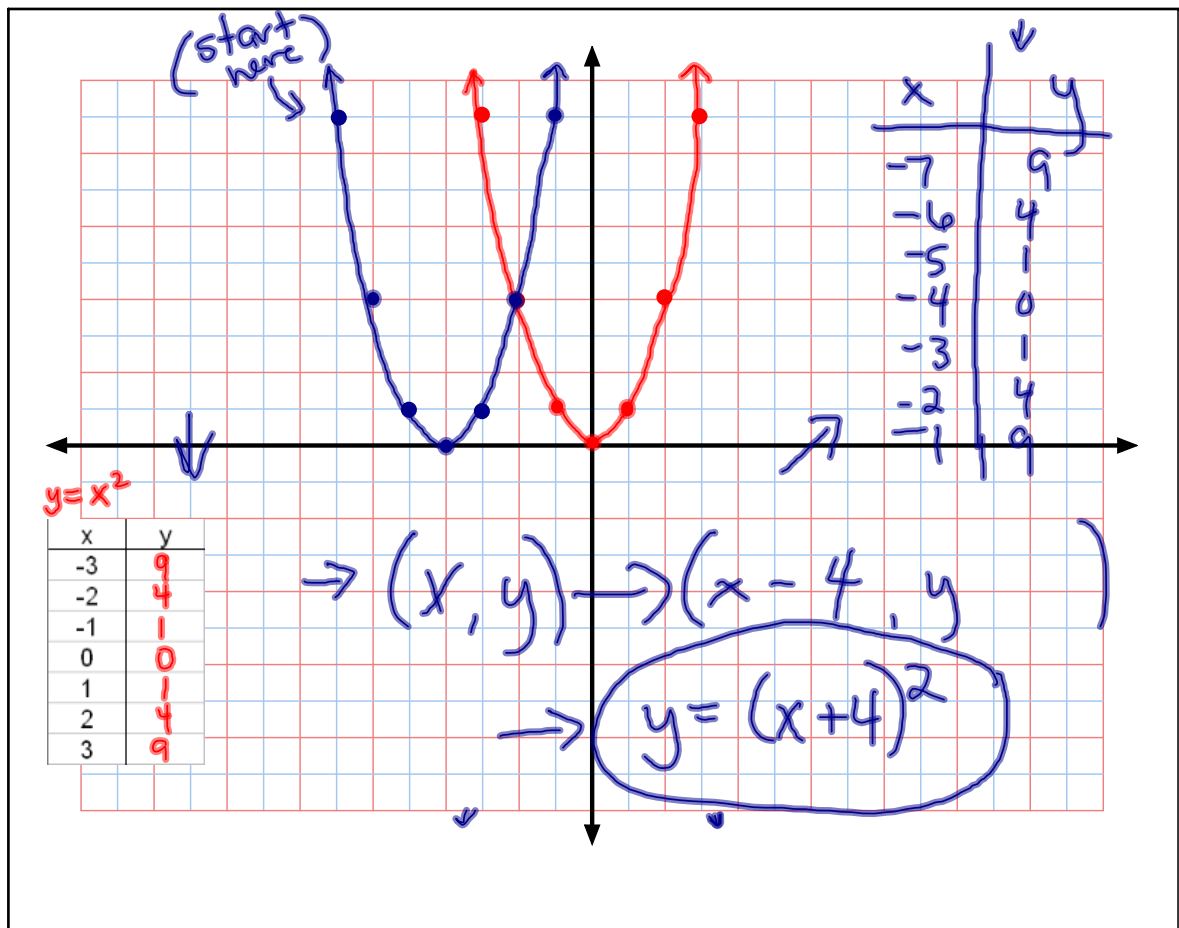
SF - Standard form Ref - Reflection VT - Vertical Translation
TF - Transformational form VS - Vertical Stretch HT - Horizontal Translation.

SF $y =$	TF $= x^2$	Ref (yes/no)	VS y/n	VT up/down	HT left/right	Mapping Notation $(x,y) \rightarrow (,)$
$y = x^2 + 1$	$y - 1 = x^2$	no	no	up 1	no	$(x,y) \rightarrow (x, y+1)$
$y = x^2 + 4$	$y - 4 = x^2$	no	no	up 4	no	$(x,y) \rightarrow (x, y+4)$
$y = x^2 - 2$	$y + 2 = x^2$	no	no	down 2	no	$(x,y) \rightarrow (x, y-2)$
$y = -x^2 + 1$	$-(y-1) = x^2$	yes	no	up 1	no	$(x,y) \rightarrow (x, -y+1)$
$y = -x^2 + 7$	$-(y-7) = x^2$	yes	no	up 7	no	$(x,y) \rightarrow (x, -y+7)$
$y = x^2 - 6$	$y + 6 = x^2$	no	no	down 6	no	$(x,y) \rightarrow (,)$

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Feb 19-8:23 PM



Feb 19-8:23 PM

Copy & Complete the following table:

SF	Ref (yes/no)	VS	VT	HT	Mapping Notation
$y = (x + 3)^2$					
$y = (x - 2)^2$					
$y = (x - 5)^2$					
$y = -(x + 6)^2$					
$y = -(x - 4)^2$					
$y = -(x - 5)^2$					

FOIL

$$y = (x+3)(x+3)$$

$$y = x^2 + 3x + 3x + 9$$

$$y = x^2 + 6x + 9$$

$$y - 6x - 9 = x^2$$

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Copy & Complete the following table:

SF	TF	Ref (yes/no)	VS	VT	HT <i>left = right</i>	Mapping Notation
$y = (x + 3)^2$	$y = x^2$	no	no	no	Left 3	$(x, y) \rightarrow (x - 3, y)$
$y = (x - 2)^2$		no			Right 2	$(x, y) \rightarrow (x + 2, y)$
$y = (x - 5)^2$		no			Right 5	$(x, y) \rightarrow (x + 5, y)$
$y = -(x + 6)^2$		yes			Left 6	$(x, y) \rightarrow (x - 6, -y)$
$y = -(x - 4)^2$		yes			Right 4	$(x, y) \rightarrow (x + 4, -y)$
$y = -(x - 5)^2$		yes			Right 5	$(x, y) \rightarrow (x + 5, -y)$

$$\begin{aligned}
 y &= (x + 3)^2 \\
 y &= (x + 3)(x + 3) \quad \text{FOIL} \\
 y &= x^2 + 3x + 3x + 9 \\
 y &= x^2 + 6x + 9 \\
 y - 6x - 9 &= x^2
 \end{aligned}$$

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Complete the worksheet on
Vertical Translations

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Warm Up

Feb. 16

1. Write a description and the mapping notation of the transformation of the following:

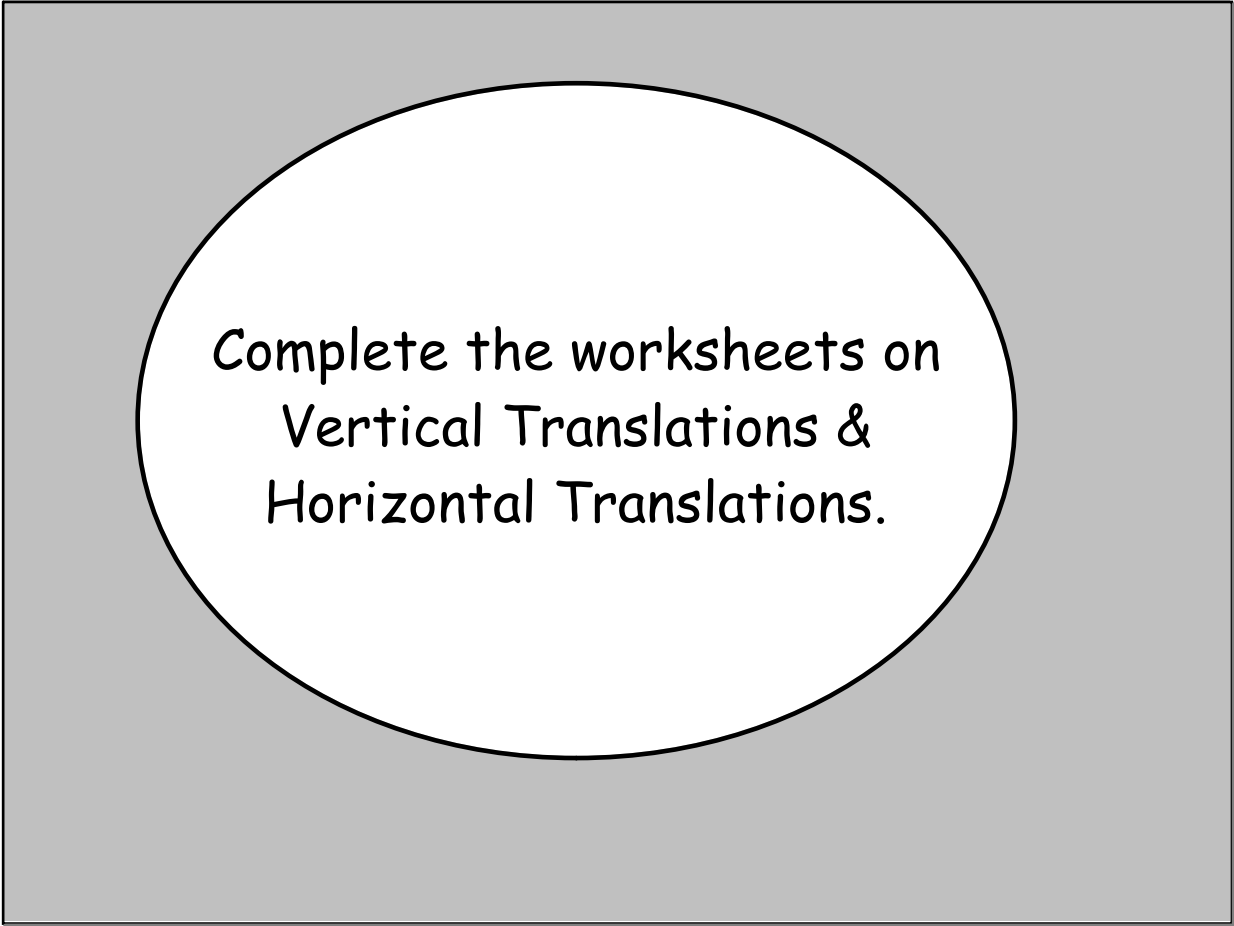
a. $y = -x^2$

b. $y = x^2 + 6$

c. $y = -2x^2 - 3$

2. What is the difference between standard and transformational form?

Feb 13-9:59 AM



Complete the worksheets on
Vertical Translations &
Horizontal Translations.

Feb 10-4:04 PM